CLAIMS

1. Method of sending an original information sequence, including:

- an encoding operation (E1), consisting of encoding said original information sequence by means of an error correction code, so as to obtain a sequence of encoded symbols;

- a frequency mapping operation (E2), consisting of associating with the sequence of encoded symbols K frequency symbols in a frequency space consisting of an ordered series of 2^p increasing frequencies, periodically spaced apart and associated with an amplitude, each of said K frequency symbols representing N encoded symbols, p, K and N being strictly positive integers;

- an inverse transformation operation (E3), consisting of applying to the K frequency symbols a reversible transformation including a multiplication by an invertible matrix of size N×N, so as to obtain inverse transform signals; and

- a transmission operation (E4), consisting of sending over a transmission channel signals obtained from said inverse transform signals;

characterised in that there exists a K-tuplet of positive integers n_1, n_2, ..., n_K, at least one of which is strictly positive, such that, for an integer i varying from 1 to K, after periodic extraction of one frequency out of 2^{ni} amongst the frequencies of the i^{th} of said K frequency symbols, thus forming a reduced frequency symbol with 2^{p-ni} frequencies, a set of K reduced frequency symbols is obtained, representing said original information sequence, with a view to a complete or partial decoding.

2. Sending method according to Claim 1, characterised in that there exists a strictly positive integer n such that, after periodic extraction of one frequency out of 2^n amongst the frequencies of each of said K frequency symbols, thus forming a reduced frequency symbol with 2^{p-n} frequencies, there is obtained a set of K reduced frequency symbols representing said original information sequence.

3. Sending method according to Claim 1 or 2, characterised in that said encoding operation (E1) includes at least one systematic recursive convolutional encoding operation.

4. Sending method according to Claim 1, 2 or 3, characterised in that said encoding operation (E1) is a turbo-encoding operation.

5. Sending method according to any of the preceding claims, characterised in that said reverse transformation operation (E3) is an inverse fast discrete Fourier transformation operation.

6. Sending method according to any of the preceding claims, in which said original information sequence has a length ℓ, characterised in that a value of N is chosen which is both a power of 2 and equal to 4ℓ.

7. Sending method according to any of the preceding claims, characterised in that said encoding operation (E1) is a turbo-encoding operation with two parities and, during said frequency mapping operation (E2), for each block of four successive frequencies, corresponding respectively to four sub-carriers:

- the systematic output (x) obtained at the end of the turbo-encoding operation is associated with the first available sub-carrier, in the sense of the lowest frequency in the block;

- the output with the second parity (y2) obtained at the end of the turbo-encoding operation is associated with the second sub-carrier in the block;

- the output with the first parity (y1) obtained at the end of the turbo-encoding operation is associated with the third sub-carrier in the block; and

- the systematic output (x) is also associated with the fourth available sub-carrier, in the sense of the highest frequency in the block.

8. Sending method according to any of Claims 1 to 6, characterised in that said encoding operation (E1) is a turbo-encoding operation with three parities and in that, during said frequency mapping operation (E2), for each block of four successive frequencies, corresponding respectively to four sub-carriers:

- the systematic output (x) obtained at the end of the turbo-encoding operation is associated with the first available sub-carrier, in the sense of the lowest frequency in the block;

- the output with the second parity (y2) obtained at the end of the turbo-encoding operation is associated with the second sub-carrier in the block;

- the output with the first parity (y1) obtained at the end of the turbo-encoding operation is associated with the third sub-carrier in the block; and

- the output with the third parity (y3) obtained at the end of the turbo-encoding operation is associated with the fourth available sub-carrier, in the sense of the highest frequency in the block.

9. Sending method according to any of the preceding claims, characterised in that it uses a modulation of the OFDM type.

10. Device for sending an original information sequence, having:

- encoding means (30; 90), for encoding said original information sequence by means of an error correction code, so as to obtain a sequence of coded symbols;

- frequency mapping means (32; 92), for associating with said sequence of encoded symbols K frequency symbols in a frequency space consisting of an ordered sequence of 2^p increasing frequencies periodically spaced apart and associated with an amplitude, each of said K frequency symbols representing N encoded symbols, p, K and N being strictly positive integers;

- inverse transformation means (34; 94), for applying to said K frequency symbols a reversible transformation including a multiplication by an invertible matrix with a size N×N, so as to obtain inverse transform signals; and

- transmission means (36; 96), for sending over a transmission channel signals obtained from said inverse transform signals;

characterised in that there exists a K-tuplet of positive integers $n_1, n_2, \ldots, n_K$, at least one of which is strictly positive, such that, for an integer i varying from 1 to K, after periodic extraction of one frequency out of 2^{ni} amongst the frequencies of the i^{th} of said K frequency symbols, thus forming a reduced frequency symbol with 2^{p-ni} frequencies, a set of K reduced frequency symbols is obtained,

representing said original information sequence, with a view to a complete or partial decoding.

11. Sending device according to Claim 10, characterised in that there exists a strictly positive integer n such that, after periodic extraction of one frequency out of 2^n amongst the frequencies of each of said K frequency symbols, thus forming a reduced frequency symbol with 2^{p-n} frequencies, there is obtained a set of K reduced frequency symbols representing said original information sequence.

12. Sending device according to Claim 10 or 11, characterised in that said encoding means (30; 90) include at least first systematic recursive convolutional encoding means.

13. Sending device according to Claim 10, 11 or 12, characterised in that said encoding means (30; 90) are turbo-encoding means.

14. Sending device according to any of Claims 10 to 13, characterised in that said reverse transformation means (34; 94) are inverse fast discrete Fourier transformation means.

15. Sending device according to any of Claims 10 to 14, in which said original information sequence has a length ℓ, characterised in that, for said predetermined number (N), a value is chosen which is both a power of 2 and equal to 4ℓ.

16. Sending device according to any of Claims 10 to 15, characterised in that said encoding means (30) are turbo-encoding means with two parities and in that said frequency mapping means (32) associate, for each block of four successive frequencies, corresponding respectively to four sub-carriers:

- the systematic output (x) of the turbo-encoding means with the first available sub-carrier, in the sense of the lowest frequency in the block;

- the output with the second parity (y2) of the turbo-encoding means with the second sub-carrier in the block;

- the output with the first parity (y1) of the turbo-encoding means with the third sub-carrier in the block; and

- the systematic output (x) also with the fourth available sub-carrier, in the sense of the highest frequency in the block.

17. Sending device according to any of Claims 10 to 15, characterised in that said encoding means (90) are turbo-encoding means with three parities and in that said frequency mapping means (92) associate, for each block of four frequencies, corresponding respectively to four sub-carriers:

- the systematic output (x) of the turbo-encoding means with the first available sub-carrier, in the sense of the lowest frequency in the block;

- the output with the second parity (y2) of the turbo-encoding means with the second sub-carrier in the block;

- the output with the first parity (y1) of the turbo-encoding means with the third sub-carrier in the block; and

- the output with the third parity (y3) of the turbo-encoding means with the fourth available sub-carrier, in the sense of the highest frequency in the block.

18. Sending device according to any of Claims 10 to 17, characterised in that it uses a modulation of the OFDM type.

19. Method of receiving signals representing an original information sequence sent by means of a transmission method according to any one of Claims 1 to 9, characterised in that, from a K-tuplet of granularity equal to positive integers $n'_1, n'_2, \ldots, n'_K$ such that each integer n'_i is less than or equal to said integer n_i, said reception method includes:

- an operation of receiving K frequency symbols sent by means of said transmission method;

- an extraction operation consisting, for each integer i varying from 1 to K, of periodically extracting one frequency out of $2^{n'i}$ amongst the frequencies of the i^{th} of said K frequency symbols received, thus forming a reduced frequency symbol with $2^{p-n'i}$ frequencies;

- a transformation operation (E6; E10; E14) consisting, for each integer i varying from 1 to K, of applying to said reduced frequency symbol with $2^{p-n'i}$ frequencies, a reversible transformation including a multiplication by an invertible matrix of size $2^{p-n'i} \times 2^{p-n'i}$; and

- an operation of decoding (E8; E12; E16) all the K reduced frequency symbols with $2^{p-n'i}$ frequencies, thus forming a decoded information sequence.

20. Reception method according to Claim 19, characterised in that said K-tuplet of granularity is determined during a choosing operation.

21. Reception method according to Claim 19 or 20, said original information sequence having been sent by means of a sending method according to Claim 2, characterised in that, from a granularity equal to a positive integer n' less than or equal to said integer n, said reception method includes:

- an operation of receiving K frequency symbols sent by means of the aforementioned transmission method;

- an extraction operation, consisting of periodically extracting one sequence out of $2^{n'}$ amongst the frequencies of each of said K frequency symbols received, thus forming a reduced frequency symbol with $2^{p-n'}$ frequencies;

- a transformation operation (E6; E10; E14), consisting of applying, to each of said K reduced frequency symbols with $2^{p-n'}$ frequencies, a reversible transformation including a multiplication by an invertible matrix of size $2^{p-n'} \times 2^{p-n'}$; and

- an operation of decoding (E8; E12; E16) all the K reduced frequency symbols with $2^{p-n'}$ frequencies, thus forming a decoded information sequence.

22. Reception method according to Claim 21, characterised in that said granularity is determined during a choosing operation.

23. Reception method according to Claim 20 or 22, characterised in that said choosing operation consists of choosing said granularity so as to be the greater, the better the reception quality.

24. Reception method according to Claim 20, 22 or 23, characterised in that said choosing operation consists of choosing said granularity from a look-up table giving the possible granularity values as a function of signal to noise ratios.

25. Reception method according to Claim 20, 22, 23 or 24, characterised in that said choosing operation consists of choosing said granularity from a look-up table giving the possible granularity values as a function of the distance between a sender using a sending method according to any one of Claims 1 to 9 and a receiver implementing said reception method.

26. Reception method according to any of Claims 19 to 25, characterised in that said transformation operation (E6; E10; E14) is a direct fast discrete Fourier transformation operation.

27. Reception method according to any of Claims 19 to 26, characterised in that said decoding operation (E8; E12; E16) consists of decoding said set of reduced frequency symbols according to a decoding technique which is a function of said granularity.

28. Reception method according to any of Claims 19 to 27, characterised in that said decoding operation (E8) is a turbodecoding operation.

29. Reception method according to any of Claims 19 to 27, characterised in that said decoding operation (E12) is a Viterbi decoding operation.

30. Reception method according to any of Claims 19 to 27, characterised in that said decoding operation (E16) is a threshold decoding operation.

31. Device for receiving signals representing an original information sequence sent by a sending device according to any one of Claims 10 to 18, characterised in that, from a K-tuplet of granularity equal to positive integers n'_1, n'_2, ..., n'_K such that each integer n'_i is less than or equal to said integer n_i, said reception device has:

- transformation means (40; 50; 60), for applying, for each integer i varying from 1 to K, to said reduced frequency symbol with $2^{p-n'i}$ frequencies, a reversible transformation including a multiplication by an invertible matrix of size $2^{p-n'i} \times 2^{p-n'i}$; and

- decoding means (44; 54; 64) for decoding all the K reduced frequency symbols with $2^{p-n'i}$ frequencies, thus forming a decoded information sequence.

32. Reception device according to Claim 31, characterised in that said K-tuplet of granularity is determined using choosing means.

33. Reception device according to Claim 31 or 32, said original information sequence having been sent by a sending device according to Claim 11, characterised in that, from a granularity equal to a positive integer n' less than or equal to said integer n, said reception device has:

- transformation means (40; 50; 60), for applying, to each of said K reduced frequency symbols with $2^{p-n'}$ frequencies, a reversible transformation including a multiplication by an invertible matrix of size $2^{p-n'}\times 2^{p-n'}$; and

- decoding means (44; 54; 64), for decoding all the K reduced frequency symbols with $2^{p-n'}$ frequencies, thus forming a decoded information sequence.

34. Reception device according to Claim 33, characterised in that said granularity is determined using choosing means.

35. Reception device according to Claim 32 or 34, characterised in that said choosing means choose said granularity so as to be the greater, the better the reception quality.

36. Reception device according to Claim 32, 34 or 35, characterised in that said choosing means choose said granularity from a look-up table giving the possible granularity values as a function of signal to noise ratios.

37. Reception device according to Claim 32, 34, 35 or 36, characterised in that said choosing means choose said granularity from a look-up table giving the possible granularity values as a function of the distance between a sender having a sending device according to any one of Claims 10 to 18 and a receiver having said reception device.

38. Reception device according to any of Claims 31 to 37, characterised in that said transformation means (40; 50; 60) are direct fast discrete Fourier transformation means.

39. Reception device according to any of Claims 31 to 38, characterised in that said decoding means (44; 54; 64) decode said set of reduced frequency symbols according to a decoding technique which is a function of said granularity.

40. Reception device according to any of Claims 31 to 39, characterised in that said decoding means (44) are turbodecoding means.

41. Reception device according to any of Claims 31 to 39, characterised in that said decoding means (54) are Viterbi decoding means.

42. Reception device according to any of Claims 31 to 39, characterised in that said decoding means (64) are threshold decoding means.

43. Digital signal processing apparatus, characterised in that it has means adapted to implement a sending method according to any of Claims 1 to 9.

44. Digital signal processing apparatus, characterised in that it has means adapted to implement a reception method according to any of Claims 19 to 30.

45. Digital signal processing apparatus, characterised in that it has a sending device according to any of Claims 10 to 18.

46. Digital signal processing apparatus, characterised in that it has a reception device according to any of Claims 31 to 42.

47. Telecommunications network, characterised in that it has means adapted to implement a sending method according to any of Claims 1 to 9.

48. Telecommunications network, characterised in that it has means adapted to implement a reception method according to any of Claims 19 to 30.

49. Telecommunications network, characterised in that it has a sending device according to any of Claims 10 to 18.

50. Telecommunications network, characterised in that it has an information reception device according to any of Claims 31 to 42.

51. Mobile station in a telecommunications network, characterised in that it has means adapted to implement a sending method according to any of Claims 1 to 9.

52. Mobile station in a telecommunications network, characterised in that it has means adapted to implement a reception method according to any of Claims 19 to 30.

53. Mobile station in a telecommunications network, characterised in that it has a sending device according to any of Claims 10 to 18.

54. Mobile station in a telecommunications network, characterised in that it has a reception device according to any of Claims 31 to 42.

55. Information storage means which can be read by a computer or microprocessor storing instructions of a computer program, characterised in that it implements a sending method according to any of Claims 1 to 9.

56. Information storage means which can be read by a computer or microprocessor storing instructions of a computer program, characterised in that it implements a reception method according to any of Claims 19 to 30.

57. Information storage means which is removable, partially or totally, and which can be read by a computer or microprocessor storing instructions of a computer program, characterised in that it implements a sending method according to any of Claims 1 to 9.

58. Information storage means which is removable, partially or totally, and which can be read by a computer or microprocessor storing instructions of a computer program, characterised in that it implements a reception method according to any of Claims 19 to 30.

59. Computer program product, characterised in that it comprises software code portions for implementing a sending method according to any of Claims 1 to 9.

60. Computer program product, characterised in that it comprises software code portions for implementing a reception method according to any of Claims 19 to 30.